

Glenn Extreme Environments Rig

at the NASA Glenn Research Center

GEER Overview

Science, technology, and planetary mission communities have a growing interest in components and systems that are capable of working in extreme (high) temperature and pressure conditions. Terrestrial applications range from scientific research, aerospace, defense, automotive systems, energy storage and power distribution, deep mining and others. As the target environments get increasingly extreme, capabilities to develop and test the sensors and systems designed to operate in such environments will be required.

An application of particular importance to the planetary science community is the ability for a robotic lander to survive on the Venus surface where pressures are nearly 100 times as that of Earth and temperatures approach 500C. The scientific importance and relevance of Venus missions are stated in the current Planetary Decadal Survey. Further, several missions to Venus were proposed in the most recent Discovery call. Despite this interest, the ability to accurately simulate Venus conditions at a scale that can test and validate instruments and spacecraft systems and accurately simulate the Venus atmosphere has been lacking.

The NASA Glenn Extreme Environment Rig (GEER), located at the NASA Glenn Research Center in Cleveland, Ohio, is designed to simulate not only the temperature and pressure extremes described, but can also accurately reproduce the atmospheric compositions of bodies in the solar system including those with acidic and hazardous elements. GEER is currently in commissioning phase for operations simulating Venus surface temperature, pressure and chemistry. The additional capability inherent in the infrastructure system can easily be modified to allow the simulation of other planetary environments such as Jupiter or Saturn. GEER is available for use by government, industry or academia.

Current GEER Capability

- Chamber rated up to 100 bar/1500 PSI and 500C (achieves Venus surface pressure and temperature

conditions). Can achieve higher pressures at lower temperatures

- Control atmosphere composition to ppb accuracy for any known atmospheric chemistry
- Built in safety features allows use of caustic and toxic elements found in the Venus and other atmospheres
- System infrastructure is designed and sized to accommodate a larger or an additional chamber
- Remote data and control access can be made available increasing efficiency and reducing costs
- Ability to conduct tests at given static test points (composition, temperature and pressure)

Planned Enhancements

- Advanced chemical analytics including Raman spectroscopy
- Sapphire viewing ports
- High speed data system for users
- Cold wall for low temperature capability
- Platforms and trays for user hardware
- Additional vessel to accommodate multiple users
- Dynamic test capability (entry chemistry profiles, dynamic altitude changes)

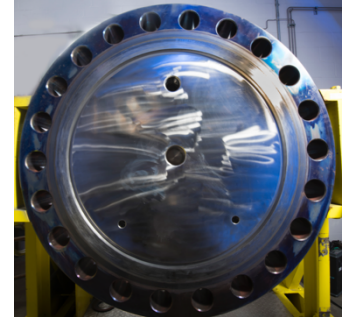
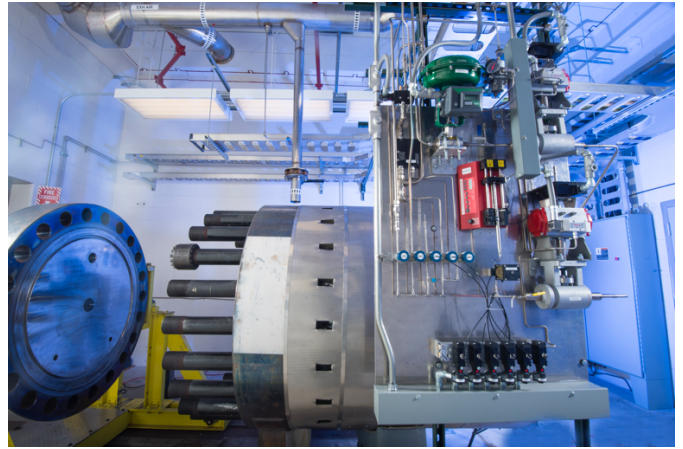
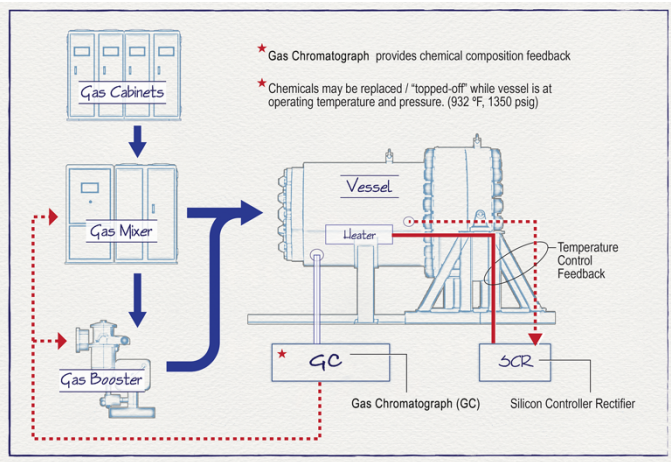


GEER at the Glenn Research Center

Process Startup Details

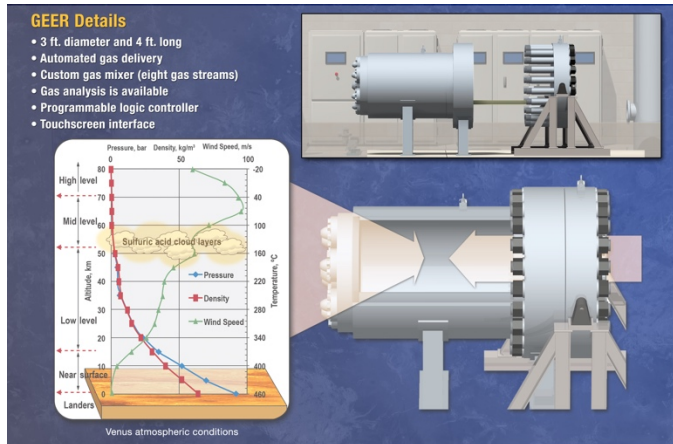
- System starts at ambient temperature and vacuum pressure
- Component gasses are blended using gas mixer
- Vessel is then filled with correct blend up to 500 psig (at ambient temperature)
- Heat is applied and controlled to bring system to steady-state operating point (1350 psig, 932 °F)
- If necessary, pressure and composition may be adjusted using gas booster

NASAfacts



Glenn Extreme Environments Rig

Sample Holders Using the GEER Center Port



For GEER users, there is a high tech 3-D simulation environment for developing experiment concepts and facility interfaces.

To explore the virtual GEER facility, visit us at:

<https://geer.grc.nasa.gov/>



For more information:
Contact Dan Vento at
(216) 433-2834
daniel.m.vento@nasa.gov

National Aeronautics and Space Administration

Glenn Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
www.nasa.gov/centers/glenn

www.nasa.gov